Name ____________________________ Date ____________________ Class ____________

Cell Structure and Function ▪ *Technology Lab*

Design and Build a Microscope

Problem

How can you design and build a compound microscope?

Design Skills

building a prototype, evaluating design constraints

Materials

book

2 dual magnifying glasses, each with one high-power and one low-power lens

metric ruler

2 cardboard tubes from paper towels, or black construction paper

tape

Procedure

Part 1 Research and Investigate

1. Work with a partner. Using only your eyes, examine words in a book. Then use the high-power lens to examine the same words. In your notebook, contrast what you saw with and without the magnifying lens.
2. Hold the high-power lens about 5–6 cm above the words in the book. When you look at the words through the lens, they will look blurry.
3. Keep the high-power lens about 5–6 cm above the words. Hold the low-power lens above the high-power lens.
4. Move the low-power lens up and down until the image is in focus and upside down. (*Hint:* You may have to move the high-power lens up or down slightly, too.)
5. Once the image is in focus, experiment with raising and lowering both lenses. Your goal is to produce the highest magnification while keeping the image in clear focus.
6. When the image is in focus at the position of highest magnification, have your lab partner measure and record the distance between the book and the high-power lens. Your lab partner should also measure and record the distance between the two lenses.
7. Write a description of how the magnified words viewed through two lenses compares with the words seen without magnification.

PART 2 Design and Build

8. Based on what you learned in Part 1, work with a partner to design your own two-lens (compound) microscope. Your microscope should
   - consist of one high-power lens and one low-power lens, each attached to a tube of paper or rolled-up cardboard

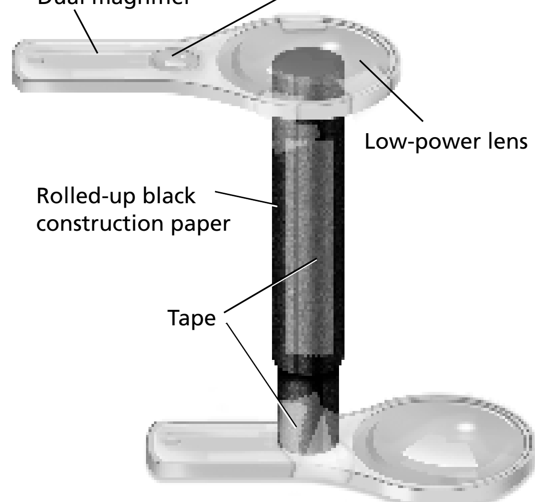
- allow one tube to fit snugly inside the other tube so the distance between the two lenses can be easily adjusted
- focus to produce a clear, enlarged, upside-down image of the object you observe
- be made from dual magnifying glasses, cardboard tubes, and tape

9. Sketch your design on a sheet of paper. Obtain your teacher's approval for your design. Then construct your microscope.

PART 3 Evaluate and Redesign

10. Test your microscope by examining printed words or a printed photograph. Then, examine other objects such as a leaf or your skin. Record your observations. Did your microscope meet the criteria listed in Step 8?

11. Examine microscopes made by other students. Based on your tests and your examination of other microscopes, list ways you could improve your microscope.



Analyze and Conclude

1. **Observing** Compare the images you observed using one lens with the image from two lenses.
2. **Evaluating Constraints** When you used two lenses, how did moving the top lens up and down affect the image? What was the effect of moving the bottom lens up and down?
3. **Building a Prototype** Describe how you built your microscope and explain why you built it that way.
4. **Evaluating the Impact on Society** Describe some of the ways that microscopes have aided scientists in their work.

Communicate

Imagine it is 1675. Write an explanation that will convince scientists to use your new microscope rather than the single-lens variety used by Leeuwenhoek.